

# SEQUENCE LISTING

<110> Meakin, Susan  
Volkening, Kathryn Elizabeth

<120> Method of Proliferating Precursor Cells

<130> 50217/005001

<140> US 10/591,741

<141> 2006-09-01

<150> PCT/CA05/000345

<151> 2005-03-04

<150> US 60/549,870

<151> 2004-03-04

<160> 8

<170> PatentIn version 3.3

<210> 1

<211> 492

<212> PRT

<213> Homo sapiens

<220>

<221> MISC\_FEATURE

<223> FRS3 from human

<400> 1

Met	Gly	Ser	Cys	Cys	Ser	Cys	Leu	Asn	Arg	Asp	Ser	Val	Pro	Asp	Asn
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His	Pro	Thr	Lys	Phe	Lys	Val	Thr	Asn	Val	Asp	Asp	Glu	Gly	Val	Glu
			20					25					30		

Leu	Gly	Ser	Gly	Val	Met	Glu	Leu	Thr	Gln	Ser	Glu	Leu	Val	Leu	His
		35					40					45			

Leu	His	Arg	Arg	Glu	Ala	Val	Arg	Trp	Pro	Tyr	Leu	Cys	Leu	Arg	Arg
	50					55					60				

Tyr	Gly	Tyr	Asp	Ser	Asn	Leu	Phe	Ser	Phe	Glu	Ser	Gly	Arg	Arg	Cys
65					70					75					80

Gln	Thr	Gly	Gln	Gly	Ile	Phe	Ala	Phe	Lys	Cys	Ser	Arg	Ala	Glu	Glu
				85					90					95	

Ile	Phe	Asn	Leu	Leu	Gln	Asp	Leu	Met	Gln	Cys	Asn	Ser	Ile	Asn	Val	100	105	110	
Met	Glu	Glu	Pro	Val	Ile	Ile	Thr	Arg	Asn	Ser	His	Pro	Ala	Glu	Leu	115	120	125	
Asp	Leu	Pro	Arg	Ala	Pro	Gln	Pro	Pro	Asn	Ala	Leu	Gly	Tyr	Thr	Val	130	135	140	
Ser	Ser	Phe	Ser	Asn	Gly	Cys	Pro	Gly	Glu	Gly	Pro	Arg	Phe	Ser	Ala	145	150	155	160
Pro	Arg	Arg	Leu	Ser	Thr	Ser	Ser	Leu	Arg	His	Pro	Ser	Leu	Gly	Glu	165	170	175	
Glu	Ser	Thr	His	Ala	Leu	Ile	Ala	Pro	Asp	Glu	Gln	Ser	His	Thr	Tyr	180	185	190	
Val	Asn	Thr	Pro	Ala	Ser	Glu	Asp	Asp	His	Arg	Arg	Gly	Arg	His	Cys	195	200	205	
Leu	Gln	Pro	Leu	Pro	Glu	Gly	Gln	Ala	Pro	Phe	Leu	Pro	Gln	Ala	Arg	210	215	220	
Gly	Pro	Asp	Gln	Arg	Asp	Pro	Gln	Val	Phe	Leu	Gln	Pro	Gly	Gln	Val	225	230	235	240
Lys	Phe	Val	Leu	Gly	Pro	Thr	Pro	Ala	Arg	Arg	His	Met	Val	Lys	Cys	245	250	255	
Gln	Gly	Leu	Cys	Pro	Ser	Leu	His	Asp	Pro	Pro	His	His	Asn	Asn	Asn	260	265	270	
Asn	Glu	Ala	Pro	Ser	Glu	Cys	Pro	Ala	Gln	Pro	Lys	Cys	Thr	Tyr	Glu	275	280	285	
Asn	Val	Thr	Gly	Gly	Leu	Trp	Arg	Gly	Ala	Gly	Trp	Arg	Leu	Ser	Pro	290	295	300	
Glu	Glu	Pro	Gly	Trp	Asn	Gly	Leu	Ala	His	Arg	Arg	Ala	Ala	Leu	Leu	305	310	315	320

His Tyr Glu Asn Leu Pro Pro Leu Pro Pro Val Trp Glu Ser Gln Ala  
 325 330 335

Gln Gln Leu Gly Gly Glu Ala Gly Asp Asp Gly Asp Ser Arg Asp Gly  
 340 345 350

Leu Thr Pro Ser Ser Asn Gly Phe Pro Asp Gly Glu Glu Asp Glu Thr  
 355 360 365

Pro Leu Gln Lys Pro Thr Ser Thr Arg Ala Ala Ile Arg Ser His Gly  
 370 375 380

Ser Phe Pro Val Pro Leu Thr Arg Arg Arg Gly Ser Pro Arg Val Phe  
 385 390 395 400

Asn Phe Asp Phe Arg Arg Pro Gly Pro Glu Pro Pro Arg Gln Leu Asn  
 405 410 415

Tyr Ile Gln Val Glu Leu Lys Gly Trp Gly Gly Asp Arg Pro Lys Gly  
 420 425 430

Pro Gln Asn Pro Ser Ser Pro Gln Ala Pro Met Pro Thr Thr His Pro  
 435 440 445

Ala Arg Ser Ser Asp Ser Tyr Ala Val Ile Asp Leu Lys Lys Thr Val  
 450 455 460

Ala Met Ser Asn Leu Gln Arg Ala Leu Pro Arg Asp Asp Gly Thr Ala  
 465 470 475 480

Arg Lys Thr Arg His Asn Ser Thr Asp Leu Pro Leu  
 485 490

<210> 2  
 <211> 491  
 <212> PRT  
 <213> Mus musculus

<220>  
 <221> MISC\_FEATURE  
 <223> FRS3 from mouse

<400> 2

Met Gly Ser Cys Trp Ser Cys Leu Asp Arg Asp Ser Val Pro His Asn

1		5		10		15													
His	Pro	Thr	Lys	Phe	Lys	Val	Thr	Asn	Val	Asp	Asp	Glu	Gly	Val	Glu				
			20					25					30						
Leu	Gly	Ser	Gly	Val	Met	Glu	Leu	Thr	Gln	Ser	Glu	Leu	Val	Leu	His				
		35					40					45							
Leu	His	Gln	Arg	Glu	Ala	Val	Arg	Trp	Pro	Tyr	Leu	Cys	Leu	Arg	Arg				
	50					55					60								
Tyr	Gly	Tyr	Asp	Ser	Asn	Leu	Phe	Ser	Phe	Glu	Ser	Gly	Arg	Arg	Cys				
65					70					75					80				
Gln	Thr	Gly	Gln	Gly	Ile	Phe	Ala	Phe	Lys	Cys	Ser	Arg	Ala	Glu	Asp				
			85						90					95					
Ile	Phe	Asn	Leu	Leu	Gln	Asp	Leu	Met	Gln	Cys	Asn	Ser	Ile	Asn	Val				
			100					105					110						
Thr	Glu	Glu	Pro	Val	Ile	Ile	Thr	Arg	Ser	Ser	His	Pro	Pro	Glu	Leu				
		115					120					125							
Asp	Leu	Pro	Arg	Gly	Pro	Pro	Gln	Pro	Ala	Gly	Tyr	Thr	Val	Ser	Gly				
	130					135					140								
Phe	Ser	Asn	Gly	Phe	Pro	Gly	Cys	Pro	Gly	Glu	Gly	Pro	Arg	Phe	Ser				
145					150					155					160				
Ala	Pro	Arg	Arg	Pro	Ser	Thr	Ser	Ser	Leu	Arg	His	Pro	Ser	Pro	Gly				
				165					170					175					
Glu	Glu	Ser	Thr	His	Thr	Leu	Ile	Ala	Ser	Glu	Glu	Gln	Ser	His	Thr				
			180					185					190						
Tyr	Val	Asn	Thr	Pro	Thr	Gly	Asp	Glu	Asp	Gly	Arg	Ser	Arg	His	Cys				
		195					200					205							
Leu	Gln	Pro	Leu	Pro	Glu	Gly	Arg	Val	Pro	Leu	Pro	Ala	Gln	Thr	Gln				
	210					215					220								
Gly	Ser	Asp	Gln	Arg	Asp	Pro	Gln	Val	Leu	Leu	Gln	Pro	Gly	Gln	Val				
225					230					235					240				

Lys Phe Val Leu Gly Pro Thr Pro Ala Arg Arg Gln Val Met Lys Cys  
 245 250 255

Gln Ser Leu Cys Pro Gly Met Gln Asp Pro Pro His His Asn Asn Asn  
 260 265 270

Glu Gly Pro Ser Glu Cys Pro Ala Gln Pro Lys Cys Thr Tyr Glu Asn  
 275 280 285

Val Ser Gly Gly Leu Gln Gln Gly Ala Gly Trp Arg Leu Ser Pro Glu  
 290 295 300

Glu Arg Gly Trp Ser Gly Leu Ala His Arg Arg Ala Ala Leu Leu His  
 305 310 315 320

Tyr Glu Asn Leu Pro Pro Leu Pro Pro Val Trp Glu Ser Gln Gly Gln  
 325 330 335

Gln Pro Gly Gly Glu Ala Gly Asp Asp Gly Asp Ser Arg Asp Gly Leu  
 340 345 350

Thr Pro Ser Ser Asn Gly Phe Pro Asp Gly Glu Glu Asp Glu Thr Pro  
 355 360 365

Leu Gln Lys Pro Thr Ser Thr Arg Ala Ser Ala Arg Ser His Ser Gly  
 370 375 380

Phe Pro Val Pro Leu Thr Arg Arg Arg Gly Ser Pro Arg Val Phe Asn  
 385 390 395 400

Phe Asp Phe Arg Arg Gln Gly Pro Glu Pro Pro Arg Gln Leu Asn Tyr  
 405 410 415

Ile Gln Val Glu Leu Lys Gly Trp Gly Thr Ala Arg Pro Lys Gly Pro  
 420 425 430

Gln Asn Pro Ser Val Ser Gly Ala Pro Gly Pro Thr Pro His Pro Val  
 435 440 445

Arg Ser Ser Asp Ser Tyr Ala Val Ile Asp Leu Lys Lys Thr Ala Ala  
 450 455 460

Met Ser Asp Leu Gln Arg Ala Leu Pro Arg Asp Asp Gly Ala Val Arg  
 465 470 475 480

Lys Thr Arg His Asn Ser Thr Asp Leu Pro Leu  
 485 490

<210> 3  
 <211> 508  
 <212> PRT  
 <213> Homo sapiens

<220>  
 <221> MISC\_FEATURE  
 <223> FRS2 from human

<400> 3

Met Gly Ser Cys Cys Ser Cys Pro Asp Lys Asp Thr Val Pro Asp Asn  
 1 5 10 15

His Arg Asn Lys Phe Lys Val Ile Asn Val Asp Asp Asp Gly Asn Glu  
 20 25 30

Leu Gly Ser Gly Ile Met Glu Leu Thr Asp Thr Glu Leu Ile Leu Tyr  
 35 40 45

Thr Arg Lys Arg Asp Ser Val Lys Trp His Tyr Leu Cys Leu Arg Arg  
 50 55 60

Tyr Gly Tyr Asp Ser Asn Leu Phe Ser Phe Glu Ser Gly Arg Arg Cys  
 65 70 75 80

Gln Thr Gly Gln Gly Ile Phe Ala Phe Lys Cys Ala Arg Ala Glu Glu  
 85 90 95

Leu Phe Asn Met Leu Gln Glu Ile Met Gln Asn Asn Ser Ile Asn Val  
 100 105 110

Val Glu Glu Pro Val Val Glu Arg Asn Asn His Gln Thr Glu Leu Glu  
 115 120 125

Val Pro Arg Thr Pro Arg Thr Pro Thr Thr Pro Gly Phe Ala Ala Gln  
 130 135 140

Asn Leu Pro Asn Gly Tyr Pro Arg Tyr Pro Ser Phe Gly Asp Ala Ser  
 145 150 155 160

Ser His Pro Ser Ser Arg His Pro Ser Val Gly Ser Ala Arg Leu Pro  
 165 170 175

Ser Val Gly Glu Glu Ser Thr His Pro Leu Leu Val Ala Glu Glu Gln  
 180 185 190

Val His Thr Tyr Val Asn Thr Thr Gly Val Gln Glu Glu Arg Lys Asn  
 195 200 205

Arg Thr Ser Val His Val Pro Leu Glu Ala Arg Val Ser Asn Ala Glu  
 210 215 220

Ser Ser Thr Pro Lys Glu Glu Pro Ser Ser Ile Glu Asp Arg Asp Pro  
 225 230 235 240

Gln Ile Leu Leu Glu Pro Glu Gly Val Lys Phe Val Leu Gly Pro Thr  
 245 250 255

Pro Val Gln Lys Gln Leu Met Glu Lys Glu Lys Leu Glu Gln Leu Gly  
 260 265 270

Arg Asp Gln Val Ser Gly Ser Gly Ala Asn Asn Thr Glu Trp Asp Thr  
 275 280 285

Gly Tyr Asp Ser Asp Glu Arg Arg Asp Ala Pro Ser Val Asn Lys Leu  
 290 295 300

Val Tyr Glu Asn Ile Asn Gly Leu Ser Ile Pro Ser Ala Ser Gly Val  
 305 310 315 320

Arg Arg Gly Arg Leu Thr Ser Thr Ser Thr Ser Asp Thr Gln Asn Ile  
 325 330 335

Asn Asn Ser Ala Gln Arg Arg Thr Ala Leu Leu Asn Tyr Glu Asn Leu  
 340 345 350

Pro Ser Leu Pro Pro Val Trp Glu Ala Arg Lys Leu Ser Arg Asp Glu  
 355 360 365

Asp Asp Asn Leu Gly Pro Lys Thr Pro Ser Leu Asn Gly Tyr His Asn

370                                      375                                      380  
 Asn Leu Asp Pro Met His Asn Tyr Val Asn Thr Glu Asn Val Thr Val  
 385                                      390                                      395                                      400  
 Pro Ala Ser Ala His Lys Ile Glu Tyr Ser Arg Arg Arg Asp Cys Thr  
                                     405                                      410                                      415  
 Pro Thr Val Phe Asn Phe Asp Ile Arg Arg Pro Ser Leu Glu His Arg  
                                     420                                      425                                      430  
 Gln Leu Asn Tyr Ile Gln Val Asp Leu Glu Gly Gly Ser Asp Ser Asp  
                                     435                                      440                                      445  
 Asn Pro Gln Thr Pro Lys Thr Pro Thr Thr Pro Leu Pro Gln Thr Pro  
                                     450                                      455                                      460  
 Thr Arg Arg Thr Glu Leu Tyr Ala Val Ile Asp Ile Glu Arg Thr Ala  
 465                                      470                                      475                                      480  
 Ala Met Ser Asn Leu Gln Lys Ala Leu Pro Arg Asp Asp Gly Thr Ser  
                                     485                                      490                                      495  
 Arg Lys Thr Arg His Asn Ser Thr Asp Leu Pro Met  
                                     500                                      505  
  
 <210> 4  
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 <212> PRT  
 <213> Mus musculus  
  
 <220>  
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 <223> FRS2 from mouse  
  
 <400> 4  
 Met Gly Ser Cys Cys Ser Cys Pro Asp Lys Asp Thr Val Pro Asp Asn  
 1                                      5                                      10                                      15  
 His Arg Asn Lys Phe Lys Val Ile Asn Val Asp Asp Asp Gly Asn Glu  
                                     20                                      25                                      30  
 Leu Gly Ser Gly Val Met Glu Leu Thr Asp Thr Glu Leu Ile Leu Tyr  
                                     35                                      40                                      45





Lys Asp Pro Val Ser Gly Ser Gly Ala Gly Asn Thr Glu Trp Asp Thr  
275 280 285

Gly Tyr Asp Ser Asp Glu Arg Arg Asp Val Pro Pro Val Asn Lys Leu  
290 295 300

Val Tyr Glu Asn Ile Asn Gly Leu Ser Ile Pro Ser Ala Ser Gly Val  
305 310 315 320

Arg Arg Gly Arg Leu Thr Ser Thr Ser Thr Ser Asp Thr Gln Asn Ile  
325 330 335

Asn Asn Ser Ala Gln Arg Arg Pro Ala Leu Leu Asn Tyr Glu Asn Leu  
340 345 350

Pro Ser Leu Pro Pro Val Trp Glu Ala Arg Lys Leu Ser Arg Asp Glu  
355 360 365

Asp Asp Asn Leu Gly Pro Lys Thr Pro Ser Leu Asn Gly Tyr His Asn  
370 375 380

Asn Leu Asp Pro Met His Asn Tyr Val Asn Thr Glu Asn Val Thr Val  
385 390 395 400

Pro Ala Ser Ala His Lys Ile Asp Tyr Ser Lys Arg Arg Asp Cys Thr  
405 410 415

Pro Thr Val Phe Asn Phe Asp Ile Arg Arg Pro Ser Leu Glu His Arg  
420 425 430

Gln Leu Asn Tyr Ile Gln Val Asp Leu Glu Gly Gly Ser Asp Ser Asp  
435 440 445

Asn Pro Gln Thr Pro Lys Thr Pro Thr Thr Pro Leu Pro Gln Thr Pro  
450 455 460

Thr Arg Arg Thr Glu Leu Tyr Ala Val Ile Asp Ile Glu Arg Thr Ala  
465 470 475 480

Ala Met Ser Asn Leu Gln Lys Ala Leu Pro Arg Asp Asp Gly Thr Ser  
485 490 495

Arg Lys Thr Arg His Asn Ser Thr Asp Leu Pro Met  
500 505

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<220>  
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agccacccaa tgctctag

18

<210> 6  
<211> 24  
<212> DNA  
<213> artificial

<220>  
<223> synthetic DNA primer

<400> 6  
gtgggggcag gttctcatag tgcg

24

<210> 7  
<211> 24  
<212> DNA  
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<220>  
<223> synthetic DNA primer

<400> 7  
agccacccaa tgctctaggc taca

24

<210> 8  
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<212> DNA  
<213> artificial

<220>  
<223> synthetic DNA primer

<400> 8  
gtgggggcag gttctcatag tgca

24